In this case study, read: DeGroot and Schervish (2012): ch. 1

next event: sample time: spaces

set theory course web page am5131-spring-19-01. courses.soe.ucsc.edu
webcasts: webcast.ucsc.edu
user: am5-131-1
password: uncertainty-quantification

population

Happy disease?

No

Yes

0

1

0.72

1 row for each deer

population size

1 column for each variable

1 row

individual

mean $\bar{y}$ ("$y$-bar")

quantitative (numerical)

qualitative (categorical)

15 & 85

mean $\bar{y} = \theta = \frac{2}{113}$

random

$\downarrow$

sample size

$\downarrow n = 113$

$\uparrow$

sample

estimate of

1 row for each deer

population size

(mean $\bar{y}$)

2019

No

Yes

0

1

N = 800

0.075

15

\[\begin{array}{c}
15 \\
85 \\
\vdots \\
n \end{array}\]
we want our sampling method to be unbiased.

population

unsample

sample

Goal: make sample & unsample as similar as possible in all relevant ways

Simplest method:

choose sampled individuals at random

Random sampling doesn't (can't) achieve perfect similarity between sample & unsample every time, but

A) if we imagine repeating random sampling many times & averaging results, the average will achieving perfect similarity as # of repetitions increase
As sample size $n \uparrow$, it becomes harder for (sample, unsample) to differ by a lot along 2 kinds of relevant dimensions.

Random with replacement (independent identically-distributed (IID) sampling)

Random without replacement (simple random sampling)

1. If $n = 1$, $\text{IID} = \text{SRW}$
2. If $n \ll N$, $\text{IID} = \text{SRW}$
3. It is a lot smaller than prior more informative
Sample

\[ \begin{align*}
Y_t & \sim \text{uniform on } \mathbb{E}_0 \\
\mathbb{E}_0 & = 3 \\
p(\mathbb{E}_0 = 2) & = \frac{1}{3} \\
\text{total # } \mathbb{E}_0,
\end{align*} \]

elemental outcome \( \mathbb{E}_0 \)

\[ \begin{align*}
1 \text{ or more} \pmb{\geq} & = \left( \text{exactly } \frac{1}{t-5} \right) \text{ or } \left( \text{exactly } \frac{2}{t-5} \right)
\end{align*} \]

\[ P(A \text{ or } B) = P(A) + P(B) \]

\[ \begin{align*}
\text{exactly } \frac{1}{t-5} & \quad \text{and/or} \quad \text{exactly } \frac{2}{t-5} \quad \text{or} \\
\frac{10}{(t-5)} & = \text{not } \left( \text{exactly } \frac{1}{t-5} \right)
\end{align*} \]

\[ \text{opposed to} \]

\[ \text{not} \left( \text{exactly } \frac{1}{t-5} \right) = \left[ \text{not } \left( \text{exactly } \frac{1}{t-5} \right) \right] \]
\[ P(\text{not } A) \geq P(A) \]

\[ \left( \begin{array}{c}
T-S \\
\text{exact} \\
0 \\
T+S
\end{array} \right) = \left( \begin{array}{c}
\text{not } T-S \\
\text{not } 0 \\
2n \end{array} \right) \text{ and } \left( \begin{array}{c}
\text{not } T-S \\
\text{not } 0 \\
2n \end{array} \right) \text{ and } \left( \begin{array}{c}
\text{not } T-S \\
\text{not } 0 \\
2n \end{array} \right) \]

\[ P(A \text{ and } B) \geq P(A) \times P(B) \]